A Climate-Data Record (CDR) of the "clear sky" Surface Temperature of the Greenland Ice Sheet

Dorothy K. Hall
Josefino C. Comiso
Nicolo E. DiGirolamo
Christopher A. Shuman

To quantify the ice-surface temperature (IST) we are developing a climate-data record (CDR) of monthly IST of the Greenland ice sheet, from 1982 to the present using Advanced Very High Resolution Radiometer (AVHRR) and Moderate-Resolution Imaging Spectroradiometer (MODIS) data at 5-km resolution. "Clear-sky" surface temperature increases have been measured from the early 1980s to the early 2000s in the Arctic using AVHRR data, showing increases ranging from 0.57±0.02 (Wang and Key, 2005) to 0.72±0.10 deg C per decade (Comiso, 2006). Arctic warming has implications for ice-sheet mass balance because much of the periphery of the ice sheet is near 0 deg C in the melt season and is thus vulnerable to more extensive melting (Hanna et al., 2008).

The algorithm used for this work has a long history of measuring IST in the Arctic with AVHRR (Key and Haefliger, 1992). The data are currently available from 1981 to 2004 in the AVHRR Polar Pathfinder (APP) dataset (Fowler et al., 2000). J. Key/NOAA modified the AVHRR algorithm for use with MODIS (Hall et al., 2004). The MODIS algorithm is now being processed over Greenland.

Issues being addressed in the production of the CDR are: time-series bias caused by cloud cover, and cross-calibration between AVHRR and MODIS instruments. Because of uncertainties, time series of satellite ISTs do not necessarily correspond with actual surface temperatures. The CDR will be validated by comparing results with in-situ (see Koenig and Hall, in press) and automatic-weather station data (e.g., Shuman et al., 2001).

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